Let's Predict the tamato disease using the deep learning method the kaggle link given below.

https://www.kaggle.com/datasets/tulasidhanush/tomato-plant-villagesmall

```
import tensorflow as tf
from tensorflow.keras import models,layers
import numpy as np
import matplotlib.pyplot as plt
```

Define the variables such as image_size and batch size and epochs and channel

```
IMAGE_SIZE=180
BATCH_SIZE=32
EPOCHS=10
CHANNEL=3
```

```
#Load the dataset
dataset=tf.keras.preprocessing.image_dataset_from_directory("../input/tomatodataplant
                                                            batch_size=BATCH_SIZE)
```

```
Found 16011 files belonging to 10 classes.
2022-10-06 10:17:25.456341: I tensorflow/core/common_runtime/process_util.cc:146
```

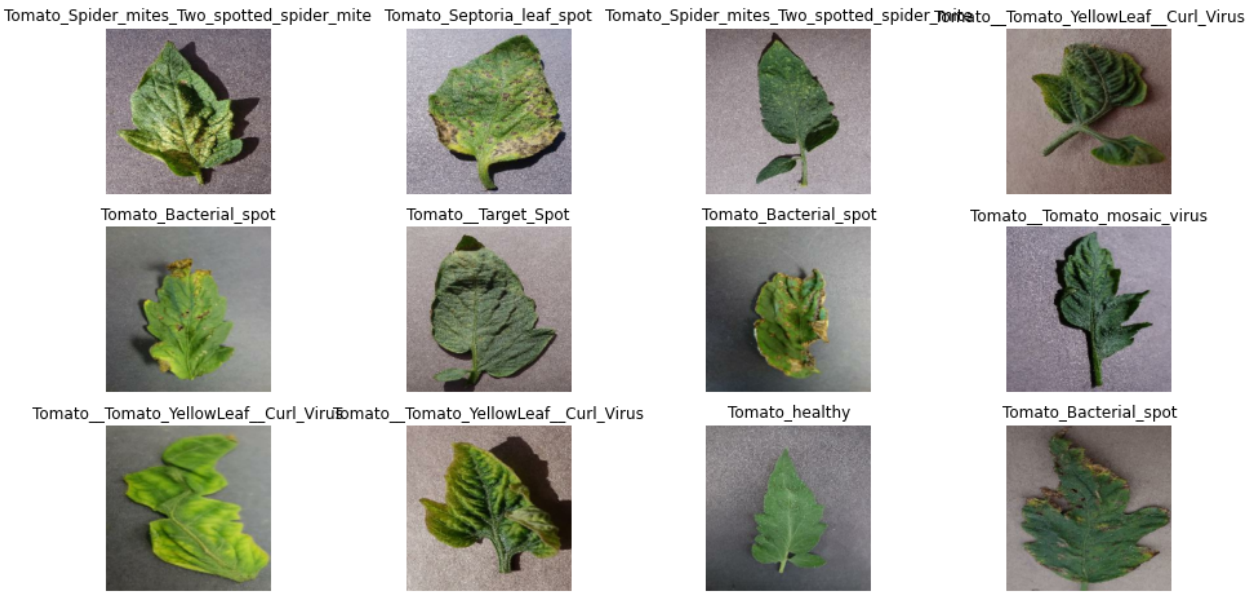
```
#Print the class names
class_names=dataset.class_names
class_names
```

```
['Tomato_Bacterial_spot',
 'Tomato_Early_blight',
 'Tomato_Late_blight',
 'Tomato_Leaf_Mold',
 'Tomato_Septoria_leaf_spot',
 'Tomato_Spider_mites_Two_spotted_spider_mite',
 'Tomato__Target_Spot',
 'Tomato__Tomato_YellowLeaf__Curl_Virus',
 'Tomato__Tomato_mosaic_virus',
 'Tomato_healthy']
```

```
for img_batch,label_batch in dataset.take(1):
    print(img_batch.shape)
    print(label_batch.numpy())
```

```
2022-10-06 10:17:25.619785: I tensorflow/compiler/mlir/mlir_graph_optimization_p
(32, 180, 180, 3)
[0 6 0 4 0 9 6 7 0 2 0 5 9 5 9 0 7 0 0 7 0 0 7 0 1 4 5 0 8 9 2 0]
```

```
plt.figure(figsize=(16,8))
for img_batch,label_batch in dataset.take(1):
    for i in range(12):
        ax=plt.subplot(3, 4, i + 1)

        plt.imshow(img_batch[i].numpy().astype("uint8"))

        plt.title(class_names[label_batch[i]])
        plt.axis("off")
```




```
def get_dataset_partition_df(ds,train_split=0.8,val_split=0.1,test_split=0.1,shuffle=
    assert (train_split + test_split + val_split) == 1

    ds_size = len(ds)
    if shuffle:
        shuffle_size=1000
```

```
        ds=ds.shuffle(shuffle_size,seed=12)

        train_size=int(train_split*ds_size)
        val_size=int(val_split*ds_size)
        train_ds=ds.take(train_size)
        val_ds=ds.skip(train_size).take(val_size)
        test_ds=ds.skip(train_size).skip(val_size)
        return train_ds,val_ds,test_ds


train_ds,val_ds,test_ds=get_dataset_partition_df(dataset)


train_ds = train_ds.cache().shuffle(1000).prefetch(buffer_size=tf.data.AUTOTUNE)
val_ds = val_ds.cache().shuffle(1000).prefetch(buffer_size=tf.data.AUTOTUNE)
test_ds = test_ds.cache().shuffle(1000).prefetch(buffer_size=tf.data.AUTOTUNE)
```

Modeling

```
#modeling
resize_and_rescale=tf.keras.Sequential([layers.experimental.preprocessing.Resizing(IM
                    layers.experimental.preprocessing.Rescaling(1./255)])


data_augmentation=tf.keras.Sequential([layers.experimental.preprocessing.RandomFlip("
                    layers.experimental.preprocessing.RandomRotation(0.2)])
```

Modeling

```
train_ds = train_ds.map(
    lambda x, y: (data_augmentation(x, training=True), y)
).prefetch(buffer_size=tf.data.AUTOTUNE)
```

!download.png

```
input_shape = (BATCH_SIZE, IMAGE_SIZE, IMAGE_SIZE, CHANNEL)
n_classes = 10
model = models.Sequential([
    resize_and_rescale,
    layers.Conv2D(32, kernel_size = (3,3), activation='relu', input_shape=input_shape
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64,  kernel_size = (3,3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
```

```
    layers.Flatten(),
    layers.Dense(64, activation='relu'),
    layers.Dense(n_classes, activation='softmax'),
])

model.build(input_shape=input_shape)



#summary of the dataset
model.summary()
```

```
Model: "sequential_2"
_________________________________________________________________
Layer (type)                 Output Shape              Param #
=================================================================
sequential (Sequential)      (32, 180, 180, 3)         0
_________________________________________________________________
conv2d (Conv2D)              (32, 178, 178, 32)        896
_________________________________________________________________
max_pooling2d (MaxPooling2D) (32, 89, 89, 32)          0
_________________________________________________________________
conv2d_1 (Conv2D)            (32, 87, 87, 64)          18496
_________________________________________________________________
max_pooling2d_1 (MaxPooling2 (32, 43, 43, 64)          0
_________________________________________________________________
flatten (Flatten)            (32, 118336)              0
_________________________________________________________________
dense (Dense)                (32, 64)                  7573568
_________________________________________________________________
dense_1 (Dense)              (32, 10)                  650
=================================================================
Total params: 7,593,610
Trainable params: 7,593,610
Non-trainable params: 0
_________________________________________________________________
```

```
#complie the model with optimizer and loss and metric
model.compile(optimizer='adam',loss=tf.keras.losses.SparseCategoricalCrossentropy(fro
              metrics=['accuracy'])


#fit the model with train_ds and batch_size abd validatun set
history = model.fit(
    train_ds,
    batch_size=BATCH_SIZE,
    epochs=EPOCHS,
    validation_data=val_ds,
    verbose=1

)
```

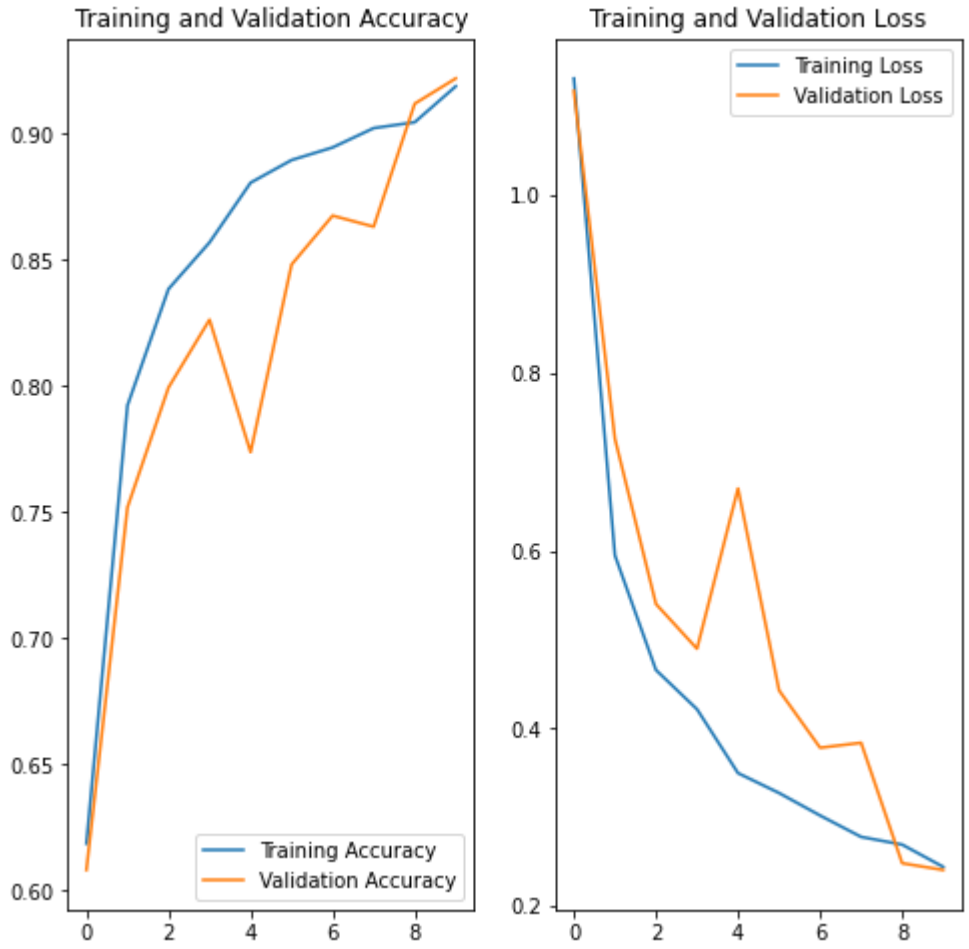
```
Epoch 1/10
2022-10-06 10:17:39.093391: I tensorflow/core/kernels/data/shuffle_dataset_op.cc
2022-10-06 10:17:49.138139: I tensorflow/core/kernels/data/shuffle_dataset_op.cc
2022-10-06 10:17:59.100359: I tensorflow/core/kernels/data/shuffle_dataset_op.cc
2022-10-06 10:18:00.405593: I tensorflow/core/kernels/data/shuffle_dataset_op.cc
2022-10-06 10:18:00.405686: I tensorflow/core/kernels/data/shuffle_dataset_op.cc
2022-10-06 10:18:00.405700: I tensorflow/core/kernels/data/shuffle_dataset_op.cc
2022-10-06 10:18:00.405711: I tensorflow/core/kernels/data/shuffle_dataset_op.cc
2022-10-06 10:18:00.406868: I tensorflow/core/kernels/data/shuffle_dataset_op.cc
400/400 [==============================] - ETA: 0s - loss: 1.1318 - accuracy: 0.
2022-10-06 10:21:42.267803: I tensorflow/core/kernels/data/shuffle_dataset_op.cc
2022-10-06 10:21:42.270033: I tensorflow/core/kernels/data/shuffle_dataset_op.cc
2022-10-06 10:21:42.270447: I tensorflow/core/kernels/data/shuffle_dataset_op.cc
400/400 [==============================] - 259s 567ms/step - loss: 1.1318 - accu
Epoch 2/10
400/400 [==============================] - 208s 520ms/step - loss: 0.5947 - accu
Epoch 3/10
400/400 [==============================] - 207s 517ms/step - loss: 0.4656 - accu
Epoch 4/10
400/400 [==============================] - 211s 526ms/step - loss: 0.4215 - accu
Epoch 5/10
400/400 [==============================] - 209s 522ms/step - loss: 0.3495 - accu
Epoch 6/10
400/400 [==============================] - 206s 515ms/step - loss: 0.3271 - accu
Epoch 7/10
400/400 [==============================] - 207s 518ms/step - loss: 0.3018 - accu
Epoch 8/10
400/400 [==============================] - 208s 518ms/step - loss: 0.2777 - accu
Epoch 9/10
400/400 [==============================] - 217s 543ms/step - loss: 0.2690 - accu
Epoch 10/10
400/400 [==============================] - 210s 525ms/step - loss: 0.2439 - accu
```

```
#Evaluate the model score
scores = model.evaluate(test_ds)
scores
```

```
2022-10-06 10:56:04.015411: I tensorflow/core/kernels/data/shuffle_dataset_op.cc
 1/51 [..............................] - ETA: 12:36 - loss: 0.3388 - accuracy: 0
2022-10-06 10:56:09.014098: I tensorflow/core/kernels/data/shuffle_dataset_op.cc
2022-10-06 10:56:09.014469: I tensorflow/core/kernels/data/shuffle_dataset_op.cc
51/51 [==============================] - 20s 106ms/step - loss: 0.2608 - accurac
[0.26084762811660767, 0.9105392098426819]
```

```
#Let's create the variable with loss and accuracy score
acc = history.history['accuracy']
val_acc = history.history['val_accuracy']

loss = history.history['loss']
val_loss = history.history['val_loss']
```

```
#To visualize the loss and accuracy score using the matplotlib
plt.figure(figsize=(8, 8))
plt.subplot(1, 2, 1)
plt.plot(range(EPOCHS), acc, label='Training Accuracy')
plt.plot(range(EPOCHS), val_acc, label='Validation Accuracy')
plt.legend(loc='lower right')
plt.title('Training and Validation Accuracy')

plt.subplot(1, 2, 2)
plt.plot(range(EPOCHS), loss, label='Training Loss')
plt.plot(range(EPOCHS), val_loss, label='Validation Loss')
plt.legend(loc='upper right')
plt.title('Training and Validation Loss')
plt.show()
```

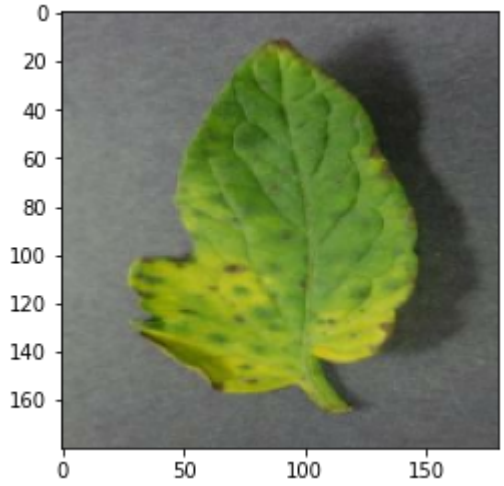


Prediction of the images

```
for images_batch, labels_batch in test_ds.take(1):

    first_image = images_batch[0].numpy().astype('uint8')
```

```
    first_label = labels_batch[0].numpy()

    print("first image to predict")
    plt.imshow(first_image)
    print("actual label:",class_names[first_label])

    batch_prediction = model.predict(images_batch)
    print("predicted label:",class_names[np.argmax(batch_prediction[0])])
```

```
first image to predict
actual label: Tomato__Tomato_YellowLeaf__Curl_Virus
predicted label: Tomato__Tomato_YellowLeaf__Curl_Virus
```

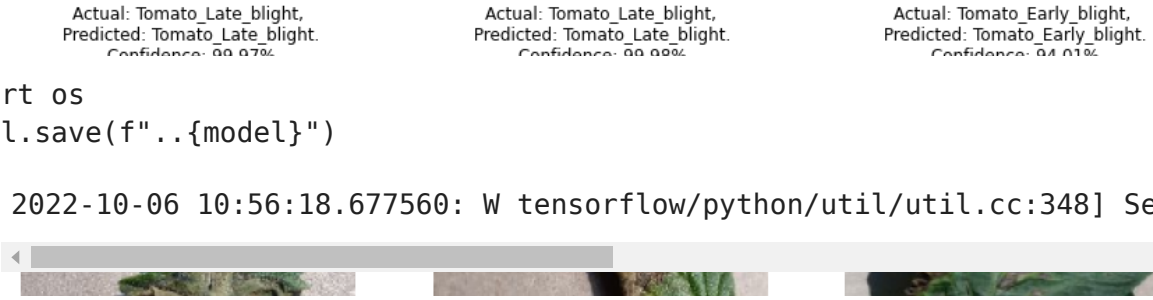


Check the model evalution of the images

```
def predict(model, img):
    img_array = tf.keras.preprocessing.image.img_to_array(images[i].numpy())
    img_array = tf.expand_dims(img_array, 0)

    predictions = model.predict(img_array)

    predicted_class = class_names[np.argmax(predictions[0])]
    confidence = round(100 * (np.max(predictions[0])), 2)
    return predicted_class, confidence
```

```
plt.figure(figsize=(15, 15))
for images, labels in test_ds.take(1):
    for i in range(9):
        ax = plt.subplot(3, 3, i + 1)
        plt.imshow(images[i].numpy().astype("uint8"))

        predicted_class, confidence = predict(model, images[i].numpy())
        actual_class = class_names[labels[i]]
```

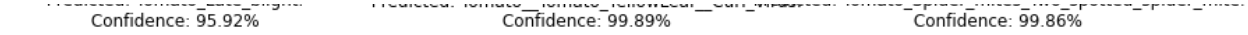
```
        plt.title(f"Actual: {actual_class},\n Predicted: {predicted_class}.\n Confide

        plt.axis("off")
```




```
import os
model.save(f"..{model}")
```

```
2022-10-06 10:56:18.677560: W tensorflow/python/util/util.cc:348] Sets are not c
```

And finaly save the model in the h5 model




```
model.save("Tomato disease1.h5")
```

```
model.save("Tomato disease1.hdf5")
```

About the data:

1. The dataset is taken from the kaggle website and fristly we load the data and add the parameters and such as image shape and rgb etc. And model is compile to the adam optimize this is best optimize to model and check the accuracy score we use the metrics as accuracy.
2. Once load the data in our model is buliding is beginig with CNN architecture in with the relu activation function and finally we add softmax activation. with 10 epochs our model predict 91% accuracy_score. then we plot the accuracy and loss function using the matplotlibe then finally we predict the our model predict the images good or bad. So we conclude that our model will be predict good result.then we save the model using the .h5 and hdf5 file and we deployee the model using the streamlit app